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Quigley

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[54] **IN-LINE AUTOMATED ROLL STAND**

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[52] **U.S. Cl.** **242/559.4**; 242/559; 414/911

[58] **Field of Search** 242/559, 559.4, 242/592, 597.1, 129.71, 557; 414/911

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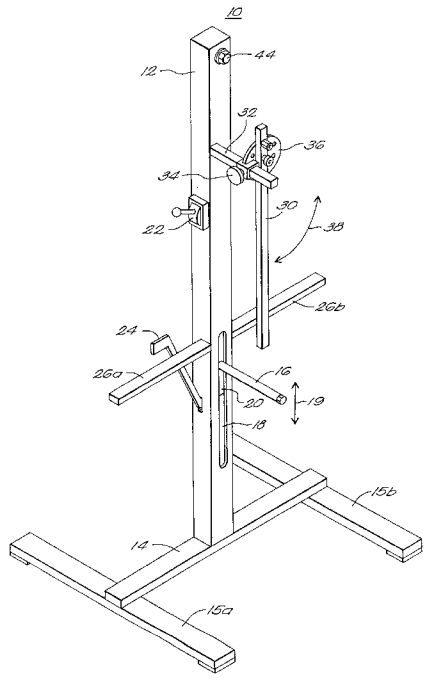
[57] **ABSTRACT**

A roll stand for holding rolls of material such as paper rolls which allows the rolls to be mounted and material fed out. The roll stand includes a roll supporting bar which is raised and lowered by a mechanical system such as an air piston. The roll supporting bar is lowered to allow a roll of material to be mounted, and then raised to allow the roll to turn freely. The roll stand includes a roll retainer, including a bar which swings down against the end of the roll, to keep the roll properly positioned on the roll supporting bar. The roll retainer swings up out of the way while a roll of material is mounted or removed. A rotating mechanism maintains the roll retainer in whatever position it is moved to. The roll stand may also be configured to support a plurality of rolls, each roll lifted into place on its own roll supporting bar. The roll supporting bars are positioned to hold all the rolls with a minimum of floor space.

9 Claims, 4 Drawing Sheets



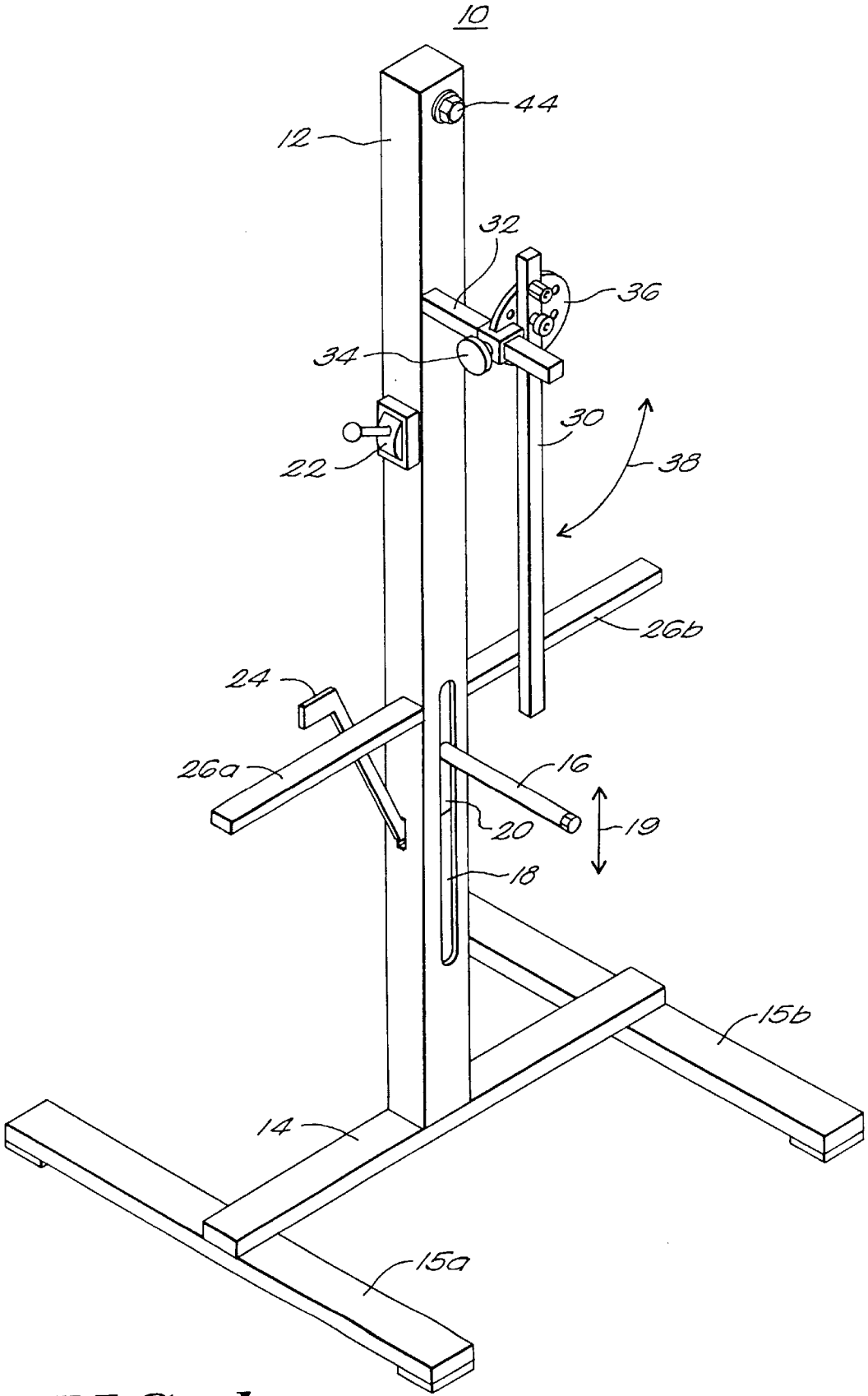


FIG. 1

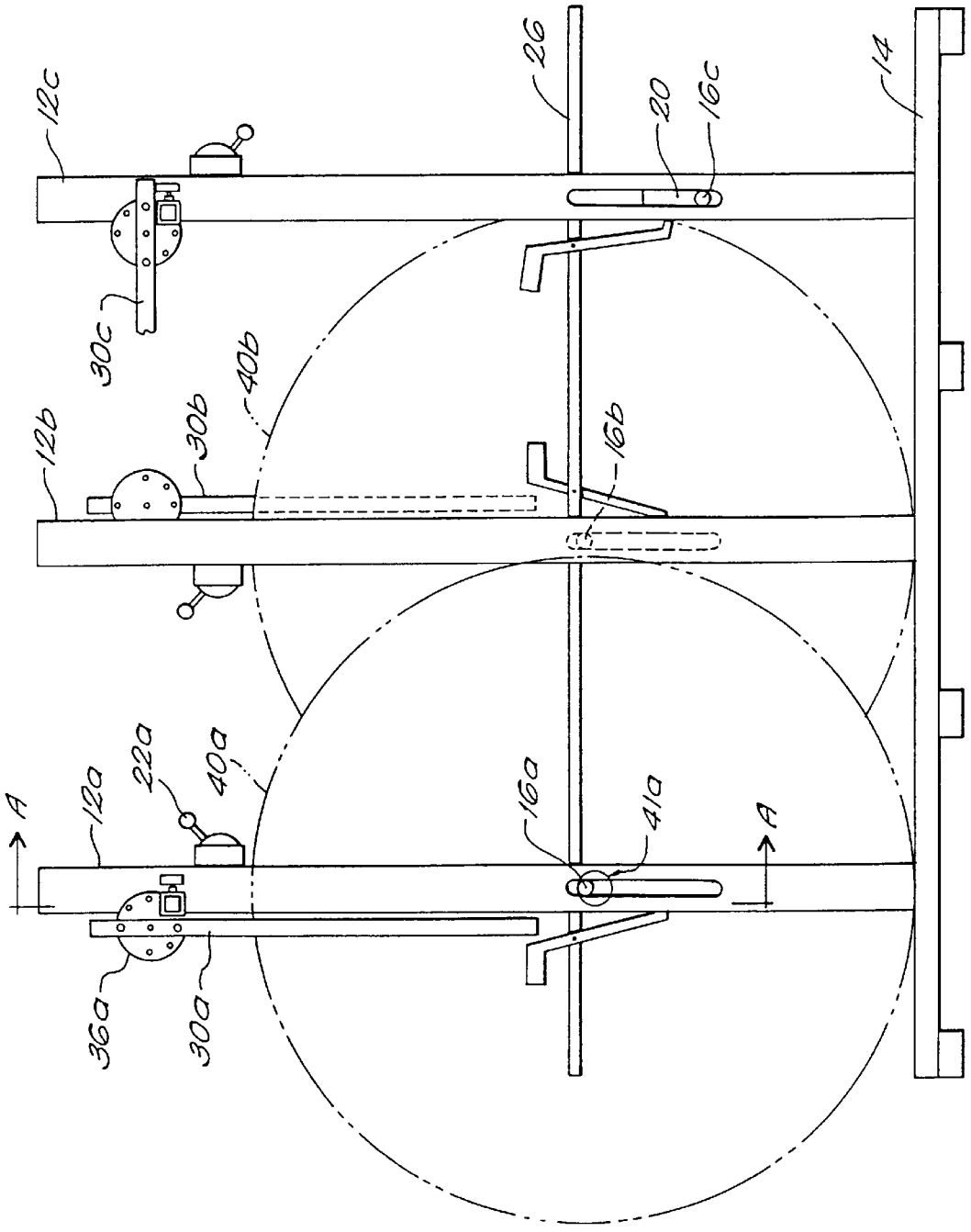

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FIG. 2

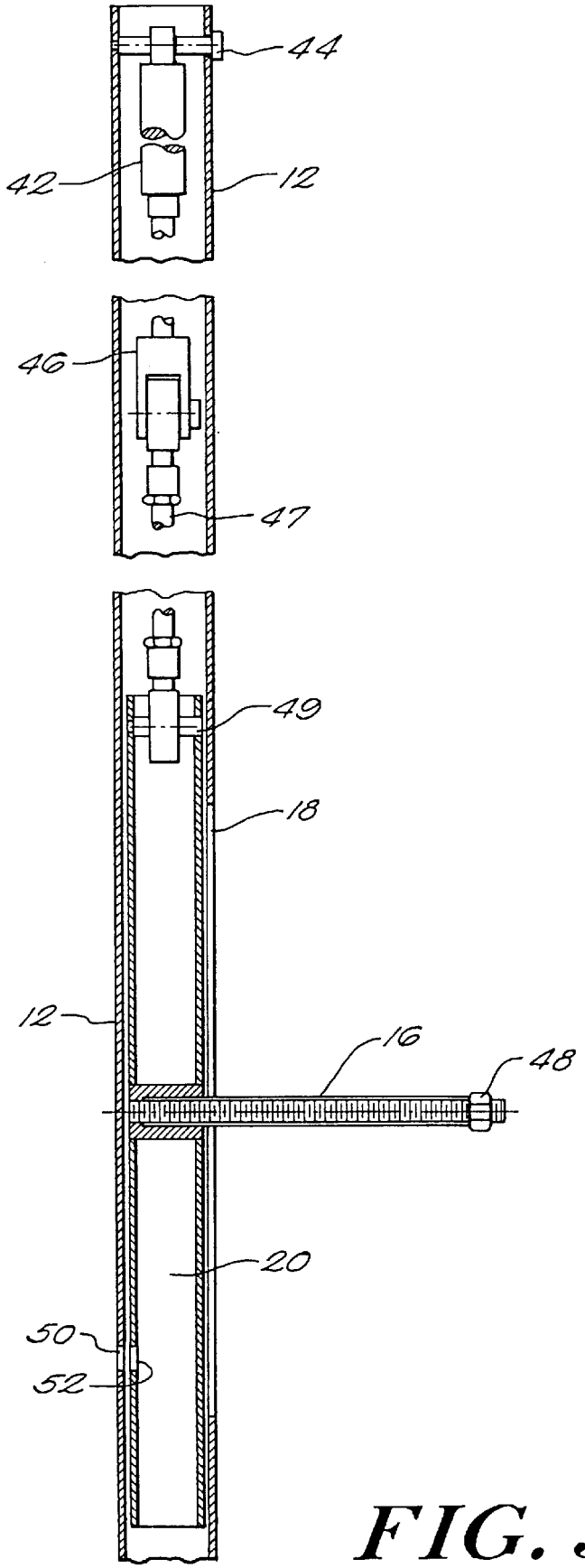

FIG. 3

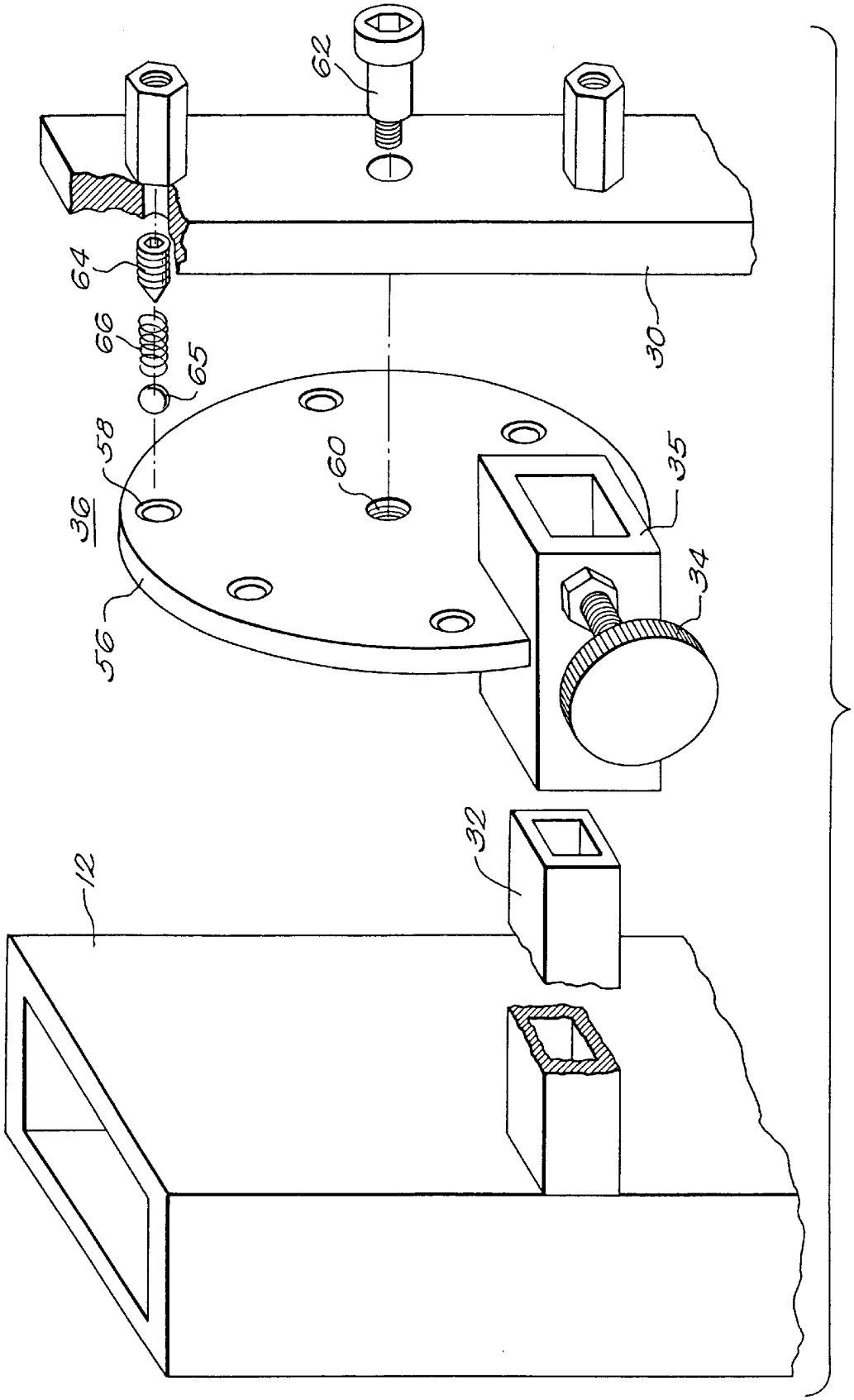

FIG. 4

IN-LINE AUTOMATED ROLL STAND

FIELD OF THE INVENTION

This invention relates to manufacturing equipment including roll stands, and more particularly, to an automatic powered roll stand for mounting and feeding out rolls of material, including paper for manufacturing paper tubes.

BACKGROUND

In the manufacturing industry, many different types of material are transported and used from rolls. In the factory, these rolls must be moved to proper locations and then mounted on various types of machinery for unwinding the material. For example, rolls of paper are fed out and processed to construct many products, including boxes and paper tubes. The rolls of paper can be quite large including sizes of 8" width paper on 70" diameter rolls and weigh anywhere up to 400–500 lbs.

These rolls have center holes and are typically mounted via the center hole on stands to be fed out. Many known stands allow rolls to be mounted on a roll bar which is simply a horizontally mounted bar for receiving the center hole of the roll. For the material to unwind without obstruction, the roll bar must be located far enough off the ground so a full roll does not contact any surface which would prevent its unwinding. Therefore, in common use, a worker must carry or transport or even roll the roll over to the stand and then physically lift the roll onto the roll bar. With rolls of varying sizes and weight, this is an incredibly strenuous operation and can easily result in back strains or other injuries. Often, the roll is so heavy that a mechanical assistance device such as a ramp, forklift or jack must be used to lift the roll far enough up and get it onto the stand roll bar. However, even with mechanical assistance, mounting the roll onto the roll bar is a slow, cumbersome and difficult operation. Production runs suffer as set up time increases.

Another problem is that many manufacturing techniques require many rolls of material to supply material simultaneously. For example, in paper tube construction, a plurality of strips of paper are glued and then pressed together in a circular overlapping roll, which produces a continuous paper tube which may then be cut to size. A number of strips of paper must be simultaneously drawn off of different rolls to be combined in the manufacturing process. Accordingly, roll stands are often manufactured to support a plurality of rolls. These multiple roll stands all suffer from the same problems as individual roll stands, including the difficulty of loading rolls onto the roll stands and the inability of roll stands to support rolls of various sizes and shapes.

In manufacturing paper tubes the rolls must be disposed in close proximity to one another. Multiple roll stands also suffer the disadvantage that the rolls are typically disposed parallel to one another. Consequently, multiple roll stands take up a lot of space on a manufacturing floor. Known in-line stands require manual lifting of the roll, and typically are configured so that rolls can not be placed in close proximity to one another.

SUMMARY

The present invention provides an in-line, automated roll stand facilitating easy and safe mounting of rolls of material, while maintaining the rolls in a proper position to feed out the material.

According to the invention the roll stand apparatus comprises a substantially vertical support component, with a roll supporting bar component coupled to the substantially vertical support component. The roll supporting bar component is configured to raise and lower along a portion of the substantially vertical support, as a function of a lifting component that is coupled to the roll supporting bar component and the substantially vertical support component. The roll support bar component is raised by a pneumatic implementation that automatically lifts a heavy roll without requiring significant effort by a worker.

The roll stand apparatus includes a roll retaining component, coupled to the substantially vertical support component above the roll supporting bar component. The roll retaining component includes a horizontal component extending out from the substantially vertical support component, and a swinging or vertical component extending outwardly from the horizontal component, and pivotally coupled to the horizontal component. The apparatus also includes a locking component coupled to the substantially vertical support component. When engaged, the locking component prevents vertical movement of the roll supporting bar component to substantially prevent any danger of rolls dropping unexpectedly.

An alternative embodiment of the present invention includes a plurality of substantially vertical support components disposed in-line with a common frame. Each station in the multiple roll stand according to the invention, includes a corresponding roll supporting bar component, lifting component and roll retaining component. The common frame couples each of the substantially vertical beam components in a row i.e. in-line as opposed to parallel. The roll supporting bar components are mounted on alternate sides of respective ones of a plurality of substantially vertical beam components, thereby allowing close spacing of the rolls of material for a compact design which saves floor space.

Features and advantages of the present invention include very easy operation for mounting rolls of material such as paper onto a roll stand, and lifting the rolls into proper position for feed out. Any manual effort and strength required to lift the rolls is effectively eliminated, thereby substantially preventing injury. Rolls are loaded and unloaded very quickly, with a minimum number of workers.

Other advantages include reliable safety features which prevent heavy rolls of material from coming off the stand, or dropping down unexpectedly. Safety lock mechanisms allow the apparatus to be unaffected by power or pressure losses.

Other advantages include a simple and economical design which can be constructed out of common components. There are no complicated mechanisms which are subject to break downs from heavy use.

With the automated, in-line, multiple roll stand according to the invention, rolls can be much more closely spaced than known implementations, allowing an increased number of production systems for a given amount of floor space.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of the present invention will be more fully understood from the following detailed description of illustrative embodiments, taken in conjunction with the accompanying drawings in which:

FIG. **1** is an overview of an illustrative embodiment of a single station roll stand according to the present invention;

FIG. **2** illustrates an embodiment of the present invention configured to hold multiple rolls of material;

FIG. **3** is a cross-sectional view of a portion of the roll stand including a roll support bar and lifting mechanism according to the present invention; and

FIG. **4** is an exploded view of a portion of a roll retaining component according to the present invention.

DETAILED DESCRIPTION

An illustrative embodiment of a roll stand **10** according to the present invention is shown in FIG. **1**. The roll stand **10** includes a substantially vertical support **12**. The vertical support or beam **12** is supported upright by a cross brace **14** and side braces **15***a* and **15***b*. Alternatively, the vertical support **12** may be supported from the top or embedded into a floor, etc. The side braces **15***a* and **15***b* rest on the floor on shock absorbing pads, or alternatively may be mounted on rollers to facilitate moving the roll stand **10** to different locations.

The roll stand **10** includes a roll supporting bar **16**. This roll supporting bar **16** is for supporting the roll of material (not shown) and allowing the material to be drawn off a mounted roll. The roll supporting bar **16** extends outwardly from the vertical support **12** through a bar opening **18**. The bar opening **18** is generally a vertical oval opening, allowing vertical motion of the roll supporting bar **16** as shown by arrow **19**. The roll supporting bar **16** in the illustrative embodiment is rigidly attached to a sliding insert sleeve **20** which fits inside of vertical support **12** as discussed hereinafter.

The vertical support **12** encloses a lifting mechanism for raising and lowering the roll supporting bar **16**. A lifting control device **22** allows activation of the lifting mechanism to raise and lower the roll supporting bar **16**. Details of the lifting control and lifting mechanism are discussed hereinafter as well.

A lifting lock **24** comprising a gravity actuated locking mechanism which engages the sliding insert sleeve **20** inside the vertical support **12** maintains the roll supporting bar **16** in a lifted position. This is to prevent the unexpected movement of the control bar **16** at any improper time. The roll stand **10** also may include side support bars **26***a* and **26***b* which maintain the roll in a proper plane as the roll material is fed out.

The illustrative embodiment of the present invention also includes a roll retainer **30** which prevents the roll from sliding off of the roll supporting bar **16** during use. The roll retainer **30** is attached to a horizontal bar **32** which in turn is attached to the vertical support **12**. The position of the roll retainer **30** is adjustable along the horizontal bar **32** by a tightening mechanism **34**, for example a screw tightening device, and will be discussed herein below. The roll retainer **30** also includes a rotational mechanism **36** which allows the roll retainer **30** to be rotated up and out of the way while a roll is mounted or unmounted. The roll retainer **30** generally rotates up as shown by arrow **38**.

An alternate embodiment of the present invention is illustrated in FIG. **2**. Here, the roll stand holds several rolls of material (**40***a* and **40***b*, shown in phantom). As shown in FIG. **2**, a roll of material **40***a* is mounted on the roll supporting bar **16***a* through the center hole **41***a* of the material **40***a*. With the roll supporting bar **16** automatically actuated to the lifted position, the roll of material **40***a* is lifted up off the floor or surface thereby allowing free rotation around the center point **41**A.

In the embodiment shown in FIG. **2**, the roll-supporting bars **16***a–c* are positioned on alternating sides of the vertical supports **12***a–c*. Also, the roll retainers **30***a–c* are mounted on alternating sides of the vertical supports **12***a–c*. This allows the rolls of material (for example rolls **40***a* and **40***b* as shown) to overlap and thereby save floor space as illustrated in FIG. **2**. The roll supporting bar **16***c* is in the lowered position for allowing the mounting of a roll **40***c* (not shown) which when raised, will also overlap roll **40***b*. This alternating design allows efficient use of space as well as positioning the rolls **40** in close proximity which is an advantage for feeding the material off of the rolls. For example, in unwinding rolls of paper, the close positioning of the rolls **40** prevents unnecessary waste between the rolls for requiring different lengths of lead paper to reach nearby machinery.

A powering mechanism having lift capacity that is a function of the weight of the rolls to be lifted is used in the present invention to raise and lower the rolls of material **40**. In the illustrative embodiment, an inner air piston **42** illustrated in FIG. **3** provides the powering or lifting component, that is enclosed inside the vertical support **12**. The air piston **42** is securely held at the top of the vertical support **12** by an anchoring system such as a bolt **44**. The inner air piston **42** in this illustrative embodiment is a 2½ BIMBA cylinder including an exhaust muffler (not shown). An air fitting is connected to the lifting control **22**. The air valve is an S.M.C. 3-way manual lever air valve which controls delivery of air to the cylinder. Pressurized air is provided through a standard hose connected to a standard air pressure source for industrial use, such as a compressor. In this illustrative embodiment inlet and outlet cylinder orifices are flow restricted, by selecting an appropriate dimension that limits the speed at which the cylinder raises and lowers the roll supporting bar **16**. The cylinder orifices are illustratively limited to one sixteenth to one eighth inch An air pressure of 100 PSI is sufficient to raise and lower rolls weighing up to 400–500 pounds. The inner piston **42** is connected through a clevis block **46** which then connects to a threaded rod **47** down to the sliding insert **20**. The threaded rod **47** is connected to the sliding insert **20** by a shoulder bolt **49**. The sliding insert **20** has the roll supporting bar **16** attached thereto.

Alternatively, other sources of lifting power may be used, including a hydraulic cylinder, electric motor with thread drive or gear, heavy duty solenoids, a lever action to assist users in applying force to lift the roll, pulley system, etc. The lifting mechanism may also be mounted below the roll supporting bar **16**, in order to push the roll up from below.

The locking mechanism **24** works via gravity to lock the sliding insert **20** to preclude inadvertent lowering by engaging a protrusion through a hole **50** in the vertical support **12** which lines up with a hole **52** in the sliding insert **20**. A single hole in the sliding insert **20** may be used for the top position, or alternatively, a number of holes may be positioned in the sliding insert **20** to allow different height adjustments. Other locking mechanisms may be used, including a frictional braking device, solenoid engaging bolt, etc.

Turning now to FIG. **4**, details of the roll retainer **30** and roll retainer ratchet or ball/detent mechanism **36** will now be discussed. The horizontal bar **32** is attached to vertical support **12** and extends out horizontally. A surrounding sleeve **35** with tightening bolt **34** is slid onto the horizontal bar **32** thereby allowing the roll retainer **30** to be adjusted for varying lengths or sizes of rolls. Once in position, the tightening mechanism **34** is tightened down against horizontal bar **32** to prevent motion. Alternatively, the horizontal bar **32** may include holes spaced along its length, with a

spring engaging bolt to engage a hole. These holes may also be spaced at appropriate positions to match standard roll sizes (not shown).

The roll retainer **30** can be held in several positions due to roll retainer ratchet mechanism **36**. In the illustrative embodiment, a ¾ cylindrical disc **56** is attached to the surrounding sleeve **35**. The cylindrical disc **56** includes a threaded center hole **60** for mounting the roll retainer **30** thereto, such as via a bolt **62**. The bolt is configured to allow the roll retainer **30** to pivot along the axis of the plane as described by the cylindrical disc **56**.

The ratchet or ball/detent mechanism **36** comprises holes or indentations **58** in the cylindrical disc **56**, engaged by a ball **65** biased by a spring **66**. A pin **64** is attached to the roll retainer **30** to retain the ball **65** and spring **66** within a void in the roll retainer **30**. In the illustrative embodiment, two ratchet mechanisms are included, thereby including matching holes **58** at 180° around the cylindrical disc **56**. As the roll retainer **30** is rotated, the engaging ball **64** is engaged in the various holes **58** in cylindrical disc **56**, to hold the roll retainer **30** in that position. Therefore, the roll retainer **30** can easily be raised to a horizontal position out of the way of the roll **40** and will remain in that position until lowered again by a worker. Although described as a system allowing a user to manually raise and lower the roll retainer **30**, an automatic system may be used employing a powered system to raise and lower retainer bar **30**, such as an air piston, or electric motor.

The illustrative embodiment of the present invention is easy to use. A worker brings a roll of material **40** over to the roll-stand **10** and raises the roll retainer up out of the way. If the roll supporting bar **16** needs to be lowered, the worker releases the lifting lock **24** which allows the roll-supporting bar **16** to drop down to the lower position. The roll **40** is mounted on the roll supporting bar **16** while the roll **40** is still supported by the floor or trolley. Once the roll **40** is in position, the worker activates the lifting control mechanism **22** thereby raising the roll-supporting bar **16** and lifting the roll **40** up. The worker then lowers the roll-retainer **30** to be adjacent to the roll **40**, thereby ensuring that the roll **40** can not work its way off the end of roll-supporting bar **16**. The worker then feeds the end of the material on roll **40***a* into the appropriate transporting mechanisms and machinery.

To remove a roll from the present invention, the above steps are reversed. The worker rotates the roll retainer **30** out of the way of the roll, as shown by the roll retainer **30***c* in FIG. **2**. The roll-retainer **30** will remain in whatever position it is set in due to the rotational mechanism **36** as will be discussed below. The worker then activates the lifting controller **22** to lower the roll down and/or releases the lifting lock **24** to allow the roll to descend until it is supported by the floor. In the illustrative embodiment, a braking force or mechanism allows the roll supporting bar **16** to lower slowly, thereby preventing an abrupt drop.

The present invention is implemented using common materials used in industry. Most elements are constructed out of industrial strength welded steel to accommodate heavy loads and stress from constant use. As shown in FIG. **3**, the vertical support **12** is preferably constructed out of box or tubular steel with the sliding insert sleeve **20** fitting slideably inside. The roll supporting bar **16** is connected to inner sleeve **20** using a threaded rod and nut **48** extending therethrough to provide maximal support.

The illustrative embodiment of the present invention is approximately 7 feet tall. The roll supporting bar **16** has a lowered position height of approximately 15 inches and an upper position height of approximately 31 inches. The roll retainer **30** is mounted on the vertical support **12** at a height of approximately 6 ft. to clear rolls up to 60 inches in diameter. The position of the roll retainer **30** can be extended out to a distance of 10 inches along the horizontal bar **32**. In multi-roll units, as illustrated in FIG. **2**, the vertical supports **12***a–c* are positioned 62 inches center to center to accommodate rolls up to 60 inches in diameter. It will be appreciated that such illustrative dimensions can be changed as a function of the application.

Although the roll stand illustrated in FIG. **2** includes roll supporting bars for three rolls, it should be appreciated that any number of structures with roll supporting bars may be used to support any number of rolls. Also, a different roll positioning arrangement may be used, including taller vertical supports **12**, with roll supporting bars **16** which raise to different heights, which allows alternating paper rolls to be raised to one height, and then the remaining rolls raised to a lower height below the first rolls.

Although the invention is shown and described with respect to an illustrative embodiment thereof, various other changes, omissions and additions in the form and detail thereof may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A roll stand for holding a roll of material, said material to be loaded on and fed out from said stand, said roll stand comprising:

a substantially vertical support component;

a roll supporting bar component, coupled to said substantially vertical support component; and

a lifting component at least a portion of which is enclosed by said substantially vertical support component and coupled to said roll supporting bar component to raise and lower said roll supporting component along a portion of said substantially vertical support component.

2. The apparatus of claim **1** further including:

a roll retaining component, coupled to said substantially vertical support component above said roll supporting bar component, said roll retaining component including a horizontal component extending out from said substantially vertical support component, and a vertical component extending down from said horizontal component, said vertical component being pivotally coupled to said horizontal component.

3. The apparatus of claim **2** wherein said vertical component is slidingly coupled to said horizontal component whereby said vertical component may be moved to any position along said horizontal component.

4. The apparatus of claim **3** including at least one ratchet mechanism allowing said vertical component to pivot up and remain in a selected position.

5. The apparatus of claim **2** comprising:

a plurality of substantially vertical support components, each one including a corresponding roll supporting bar component, lifting component and roll retaining component; and

a common connection bar component coupled to each of said substantially vertical support components in a row;

wherein said roll supporting bar components are alternately mounted in-line on left and right sides of said substantially vertical support components in a row.

6. The apparatus of claim **1** further including a locking component coupled to said substantially vertical support component, wherein when engaged, said locking component preventing movement of said roll supporting bar component.

7. The apparatus of claim **1** wherein said substantially vertical support component encloses substantially all of said lifting component and said roll supporting bar extends outwardly from said substantially vertical support component.

8. The apparatus of claim **1** wherein said substantially vertical support component includes an opening, and said roll supporting bar component extends outwardly through said opening.

9. The apparatus of claim **1** further including a sliding member, said roll supporting bar component being fixedly attached to said sliding member, said sliding member being coupled to said lifting component to raise and lower said roll supporting bar component.

* * * * *